

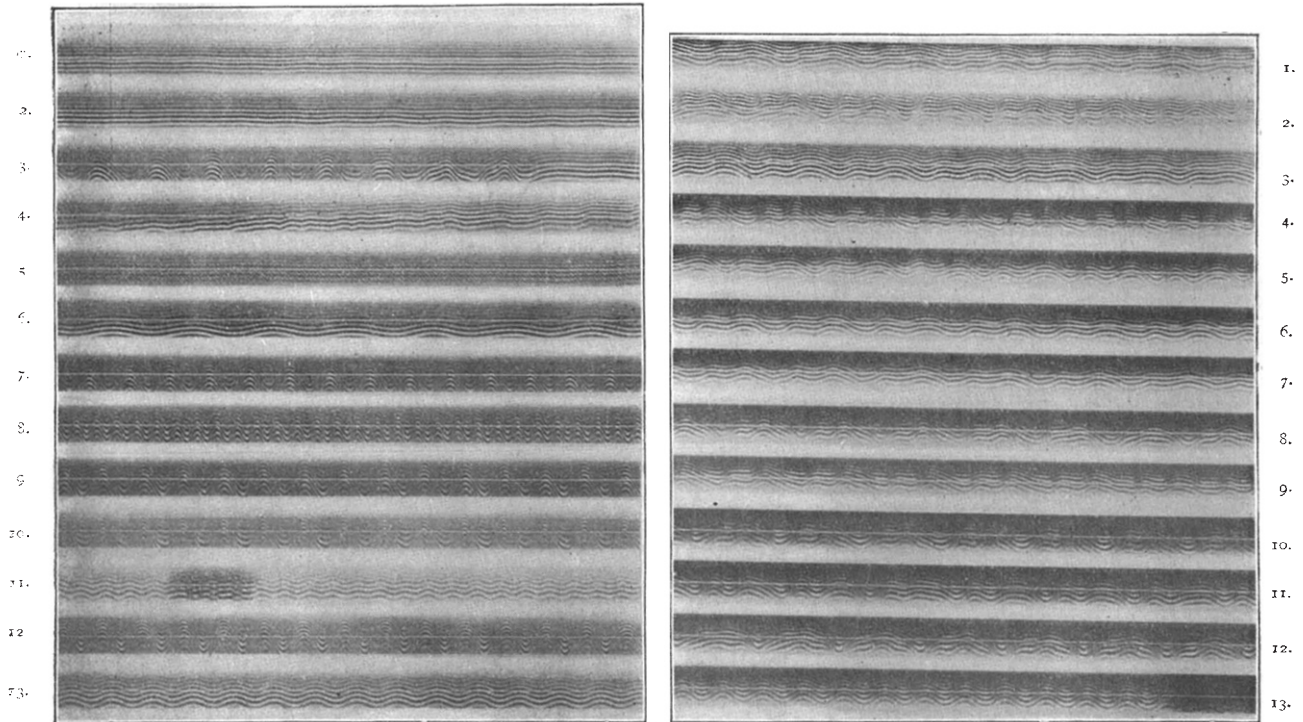
tone, simple in construction, and useful for a variety of purposes. A feeble current of a few hundredths of an ampere produces a tone that can be distinctly heard in every part of a building, 204 × 114 feet, four stories high, and containing ninety rooms. It may also be used under water.

To photograph and thus record for analysis a sound of any kind whatever, the resonator is removed by simply screwing it off, without disturbing the sensitive plate; and a camera is substituted for the telescope and eye. The window of the camera now forms the narrow slit, and a lens, placed between the window and the refractometer, focuses a narrow, horizontal strip of interference bands upon the photographic film. This film is wound about a cylinder (*cf.* Raps, *Wied. Ann.* 1893, p. 194) kept in rapid rotation by a small electric motor within the camera. The speed of this motor is kept constant by Lebedew's method (*Wied. Ann.* Band 59, p. 118). Con-

## NOTES.

As we go to press, a message from Sir Norman Lockyer at Santa Pola informs us that 130 volunteer observers have been obtained from H.M.S. *Theseus*. The instruments have been adjusted, and the Spanish authorities are assisting splendidly. The weather prospects are good.

MR. J. S. BUDGETT left Liverpool on Saturday last on his second expedition to the Gambia, where he is going in order to complete his studies of the fish-fauna of that colony, and especially to investigate the life-history and development of the abnormal fishes *Polypterus* and *Protopterus*. On reaching Bathurst, Mr. Budgett will proceed up the River Gambia to his former quarters on M'Carthy's Island, in the neighbourhood of which he has already ascertained that these fishes are found breeding during the rainy season. A memoir on some points in



1. Quiet. 2. Fanning I. 3. Fanning II. 4. Noise. 5. Flageolet.  
6. Fork  $C_{128}$ . 7. Fork  $c_{256}$ . 8. Fork  $c'_{512}$ . 9. Forks  $C+c$ . 10. Forks  
 $C+c+c'$ . 11. Forks  $g+a$ . 12. Forks  $c+e+g+c'$ . 13. Tone source.

1. (a)h. 2. (o)h. 3. p(oo)l. 4. (a)te. 5. m(ee)t. 6. s(e)t. 7. (a)t. 8. (i)t.  
9. (au)ght. 10. (e)re. 11. (u)se. 12. (u)rn. 13. Fork  $c_{256}$ .

FIG. 5.—Analyses of Fork Tones and Vowel Sounds.

sequently the lateral vibration of the bands caused by the sound, combined with the steady, vertical motion of the exposed portion of the film, is recorded in parallel, wavy lines. The shutter is opened for the time required for a single rotation of the cylinder by an electrical device. After each exposure the cylinder is moved in the direction of its axis by turning a screw from without. Thus a fresh portion of the film is brought under the shutter, without stopping the motion or opening the camera. In this way were taken the photographs of fork tones and vowels here given (Fig. 5). The photograph of a single tone from the source, whose intensity at the sensitive plate has been determined by the first method, affords a standard (*viz.* its amplitude) for determining the absolute intensity of every other sound photographed; while comparison with the wave-length appearing in the photograph of the tone of a standard fork gives the pitch of other sounds.

BENJAMIN F. SHARPE.

the anatomy of *Polypterus*, based on specimens obtained by Mr. Budgett during his first expedition, was read before the Zoological Society on May 8, and will shortly be published in the Society's *Transactions*.

AT a recent meeting of the British Ornithologists' Union and Club, under the presidency of Mr. F. D. Godman, F.R.S., the following resolution was unanimously adopted:—"That any member of the union directly or indirectly responsible for the destruction of nests, eggs, young or parent birds of any species mentioned below should be visited with the severest censure of the union and club." The birds referred to are the chough, golden oriole, hoopoe, osprey, kite, white-tailed eagle, honey buzzard, common buzzard, bittern and ruff.

THE committee of the Liverpool School of Tropical Diseases have decided to despatch, at an early date, an expedition to the Amazon to investigate yellow fever. The expedition will

probably in the first instance proceed to Baltimore to confer with the yellow fever experts at the Johns Hopkins University, afterwards going to Para and other places on the South American coast.

AN expedition, under the auspices of the Royal Dublin Society and the Royal Irish Academy, conjointly, has left Dublin for Spain, to observe the solar eclipse on May 28. The party consists of Prof. C. J. Joly, Sir Howard Grubb, F.R.S., Dr. A. Rambaut, F.R.S., Mr. W. E. Wilson, F.R.S., Prof. W. Bergin, Mr. S. Geoghegan and Mr. Rudolph Grubb. The observers have selected as their station the hill of Berrocalillo at Placencia, near Madrid, and have already had valuable assistance afforded them by Prof. Iniquez, director of the Observatory at Madrid, and his staff, who will themselves observe the eclipse at the same station.

PALÆONTOLOGISTS will be glad to know that the King of the Belgians has just made M. L. Dollo, Conservator of the Brussels Museum, a Chevalier of the Order of Leopold.

THE annual meeting of the Italian Botanical Society will be held at Venice on September 9-15, under the presidency of Sig. Sommier.

THE committee of the International Botanical Congress, to be held in Paris from October 1 to 10, has issued a fresh invitation to foreign botanists to enrol themselves as members. The subscription fee of members has been fixed at 20 fr., which will include the cost of the publications of the Congress. The following have already been fixed on as subjects for discussion at the Congress:—Monographic studies; species and hybrids; unification of micrometric measures; influence of the nature of the soil, and of the plants growing in it, on the development of fungi; and other suggestions are invited. The president of the Congress will be M. E. Prillieux; the general secretary, M. E. Perrot; and the treasurer, to whom subscriptions should be sent, M. H. Hua, rue de Villersexel 2, Paris.

A DEPARTMENTAL committee has been appointed to inquire into the conditions under which agricultural seeds are at present sold, and to report whether any further measures can with advantage be taken to secure the maintenance of adequate standards of purity and germinating power. The committee consists of the following members, viz.:—The Earl of Onslow, G.C.M.G., chairman; Sir W. T. Thiselton-Dyer, K.C.M.G., C.I.E.; Sir Jacob Wilson; Mr. R. A. Anderson, secretary of the Irish Agricultural Organisation Society; Mr. R. Stratton; Mr. Martin J. Sutton; Mr. James Watt and Mr. David Wilson. Mr. A. E. Brooke-Hunt, of the Board of Agriculture, will act as secretary to the committee.

SCIENCE is represented in the list of Birthday Honours by the names of Dr. David Gill, C.B., F.R.S., who has been promoted to the rank of Knight Commander of the Order of the Bath (K.C.B.), and Dr. T. E. Thorpe, F.R.S., who has been created a Companion of the same Order.

THE tenth International Congress of Hygiene and Demography will be held in Paris this year, on August 10-17, under the presidency of Dr. Brouardel, Dean of the Faculty of Medicine of Paris. Programmes and forms of application for membership can be obtained from the secretary of the British Committee, Dr. Paul F. Moline, 42, Walton Street, Chelsea, S.W.

A MEETING of the Institution of Mining Engineers will be held in London on June 14-16. The members have been invited to attend the International Congress of Mining and Metallurgy which will be held in Paris on June 18-23, with the object of collecting together engineers and others, who

in various parts of the world are engaged in forwarding the progress of mining and metallurgy. The Congress, like that of 1889, is under the direct patronage of the French Government.

SWEDISH metallurgy has suffered a severe loss by the death, on May 12, of Mr. G. F. Göransson, at the age of eighty-one. Without his help, the Bessemer process might perhaps never have been perfected. In 1858, at Edsken, he increased the area of the tuyeres, and succeeded in shortening the process so as to produce sufficient heat in the converter to allow of the proper separation of the slag from the metal, and thus to convert pig-iron into good steel, which having been exported to England encouraged the capitalists who were supporting Sir Henry Bessemer. At the Swedish meeting of the Iron and Steel Institute in 1898, Mr. Göransson, although very infirm, welcomed the members, in an English speech, to the Sandvik works, of which he was chairman and founder.

AT the anniversary meeting of the Royal Geographical Society, on Monday, the medals and other awards already announced (p. 34) were presented. The president, Sir Clements Markham, in the course of his anniversary address, said that a committee has been formed to obtain funds for the erection of a suitable memorial to Dr. Livingstone, on the spot where the tree stood under which the heart of the great explorer was buried. The materials will be conveyed, free of expense, from the mouth of the Zambesi to Lake Bangweolo, by the kindness of the African Lakes Corporation and the British South Africa Company. The prospects of the Antarctic expedition, from a financial point of view, have been somewhat clouded by the war. At least 30,000*l.* more than has already been raised is required. Apart from the finances, the affairs of the expedition are in a flourishing state, and everything seems hopeful. The keel of the exploring ship is now laid at Dundee. She will be the best polar exploring vessel that has ever left these shores, and the first that has ever been built in this country specially for scientific work in polar regions.

WE regret to record the death, at the age of seventy-seven, of Mr. James Thomson, F.G.S., of Shawlands, Glasgow. Among the many enthusiastic workers at Scottish geology, none had plied his hammer with more zeal. He had been an active member of the Geological Society of Glasgow for upwards of forty years, and was a frequent attendant at the meetings of the British Association. Although he had written on the geology of Islay, and on parts of Arran and the Outer Hebrides, his special researches were on the Scottish Carboniferous corals; and his contributions on this subject, carried on partly in conjunction with the late Prof. H. A. Nicholson, were numerous. He had formed an exceedingly fine collection of fossil corals, which he presented to his native town, Kilmarnock.

A POSSIBLE method of prevention of horse-sickness, which is endemic in the Orange Free State, Transvaal, Natal, Rhodesia and Bechuanaland, and also occasionally occurs in Cape Colony, is described in the *Cape Times* (April 24) by Dr. G. C. Purvis. Fortified serum, derived from immune horses, almost invariably produces fatal hæmoglobinuria when injected into horses suffering from horse-sickness. Dr. Purvis finds, however, that if the animal is gradually accustomed to the toxin, until it can receive an injection of 100 c.c. or 200 c.c. of serum, virulent blood can be injected without danger. It appears that fortified serum is a useful agent if used in a proper way, and that it is capable of preventing the onset of horse-sickness. Moreover, if, in spite of precautions, an animal acquires the disease, judicious treatment with the serum will assist in bringing about a cure.



A BACTERIOLOGICAL method of exterminating rats, proposed by M. J. Danysz of the Pasteur Institute of Paris, is described in the *British Medical Journal*. M. Danysz has found a microbe which, if introduced into a population of rats, may be trusted to breed a pestilence among them that will wipe them out, or at least make them a negligible quantity. From field-mice suffering from a spontaneous epidemic disease he isolated a cocco-bacillus presenting the general characters of *B. coli*, and thus resembling Loeffler's *B. typhi murium*. By an elaborate process of repeated cultures of this micro-organism passed through series of mice and afterwards through rats, he succeeded in intensifying its virulence so as to make it, when eaten, certainly pathogenic for the latter rodents. Having satisfied himself of the fatal effect of the cultures in the laboratory, he had them tried in a large number of farms, warehouses, and other places infested by rats. From the reports of these experiments, amounting to several hundreds, it appears that in 50 per cent. of cases the method resulted in a complete disappearance of the rats, while in 30 per cent. their number notably diminished; in 20 per cent. the method failed.

SOME interesting figures showing the high estimation in which technical knowledge is held in certain branches of industry by German manufacturers, have recently been published in the *Zeitschrift für angewandte Chemie*, from a lecture on "Technical Education and the Importance of Scientific Training," delivered before the German Emperor by Prof. J. Bredt. The following statistics, corrected to the end of last year, refer to three of the most important factories in Germany where aniline dyes are made, viz. the Badische Anilin- und Sodafabrik, of Ludwigshafen; the Farbwerke vorm. Meister Lucius und Brüning, of Höchst am Main; and the Farbenfabriken vorm. Fr. Bayer and Co., of Elberfeld.

	Ludwigshafen.	Höchst.	Elberfeld.
Workmen ... ..	6207	3670	3900
Staff ... ..	—	128	836
Chemists ... ..	146	130	130
Engineers ... ..	75	37	29

Of course, the *Engineer* remarks, conditions are somewhat different in Germany from those which obtain in this country, because these dye works own the patents for various highly lucrative proprietary articles, and manufacture numerous pharmaceutical preparations; but we should be interested to learn how many "chemical" factories in Great Britain employ over 100 skilled chemists.

AN enterprise, similar to the Edison works at Paderno, where energy of some 13,000 horse-power is derived from the River Adda, and employed for producing electricity, which is carried by overhead cable to Manzo and Milan, but on a larger scale, is, states the *Board of Trade Journal*, now on the eve of completion in Northern Italy. A report of H.M. Consul at Milan (*Foreign Office, Annual Series, 2413*) states that the Società Lombardia per distribuzione di energia Elettrica, obtained a concession from the Government on the River Ticino, at Vizzola, some miles below its issue from Lake Maggiore, and immediately set about constructing works for the development of hydraulic power of no less than 20,000 horse-power (theoretical), which will give 10,000 effective horse-power of electric energy for industrial purposes, after making full allowance for loss in transmission. Since the works were begun, the sanction of the Government has been obtained to a project for the construction of a movable dam across the river some distance higher up, which would enable the company to increase its volume of water, and allow of the same being constantly maintained during all seasons of the year. The theoretical hydraulic power would then be 24,000 and the effective electric energy 12,000 horse-power. This dam has

not yet been commenced, but the works have been constructed on the basis of the larger supply of water. Seven turbines and seven dynamos, giving three-phase alternating currents, have been put up. The dynamos and all the other electrical plant have been supplied by Germany. It was originally intended to bring all this electric energy into Milan, a distance of twenty-five miles, but the whole of it has now been disposed of in and about the manufacturing towns of Gallarate, Busto, Arsizio, Legnano and Sarsuno, which lie between Vizzola and Milan, a district which already, for the cotton industry alone, uses steam to the extent of 10,000 horse-power. This enterprise is said to be the most important of its kind in Europe. The plans are due to the initiative of Italian engineers and were made as far back as 1887, but their execution must be attributed in a large measure to the assistance of a German firm which has subscribed a considerable part of the capital of the company.

IN a recent number of NATURE (March 1, p. 421) reference was made to a paper by Dr. Lüdeling, in which diurnal variations of terrestrial magnetism were shown graphically "with the aid of von Bezold's vector diagrams." Though von Bezold appears to have been the first to use the convenient term "vector diagram" to designate the curves referred to, Dr Chree pointed out in NATURE of March 22 (p. 490) that the curves were employed by Airy in 1863, and since then by several people in this country, including Lloyd and himself, and were not used by von Bezold until 1897. Dr. Lüdeling now sends us a letter in which he states that both von Bezold and himself were well aware of the previous use of the curves, and that acknowledgment of earlier work was made in the paper briefly mentioned in NATURE.

PROF. J. JOLY has discussed "The Theory of the Order of Formation of Silicates in Igneous Rocks" (*Proceedings, Roy. Dublin Soc. ix. [N.S.] 1900*). He has lately found that the softening point of quartz is far below what is currently thought. Observations indicate that silica is a body possessing an extraordinary range of viscosity. It is a thick liquid at about 1500° C. At a temperature of about 800° C. it is plastic, and yields with considerable rapidity to distorting forces. Perhaps it never crystallises very vigorously. The author's experiments show that a silicate containing a small quantity of silica crystallises out at a higher temperature than a silicate with a larger percentage of silica; and this, according to his theory, is because the crystallising point of the one is less affected by the silica than that of the other.

IN a short article on "The Formation of Minerals in Granite" (*Memoirs, Manchester Lit. and Phil. Soc. xlv. 1900*), Mr. C. E. Stromeyer brings forward some facts and suggestions which lead him to conclude that there is no necessity to limit the temperature of granite formation, as propounded by Dr. Sorby, nor to assume that the earth's interior is solid. Not only temperature and rate of cooling, but also pressure have combined to influence the mineral composition of granites. Where the solid rock resting on the molten material is of a low specific gravity and a bad conductor of heat, the depth at which granite rock would commence to solidify would not be great, and most probably the quartz would crystallise first, forming, say, quartz-porphry. Where the rock resting on the molten mass is heavy, containing perhaps much iron-oxide, and acting as a good conductor of heat, the depth at which the granite would commence to solidify would be much greater than in the previously-mentioned case, the pressure would be much greater, and most probably the quartz would remain fluid long after the felspars had crystallised, forming, say, felspar-porphry. In the author's opinion, every intermediate condition is conceivable.

THE second volume of the *Annals* of the National Observatory of Athens contains a catalogue of the earthquakes felt in Greece during the years 1893-1898. Its value will be evident from the facts that it occupies more than 150 quarto pages and contains entries of 3187 shocks. Taking area into account, it therefore appears that earthquakes are about twice as frequent in Greece as they are in Japan. M. Eginitis, the director of the observatory, adds an interesting discussion of the catalogue. For the six years of the records, earthquakes were most numerous during the months of April and May; there is the usual apparent maximum during the early hours of the morning; and the usual doubt as to the existence of any connection between the frequency of earthquakes and the positions of the earth and moon in their orbits. There seems to be no part of the country entirely free from earthquakes, but their distribution is most irregular, 2018 shocks having been recorded in Zante alone. The volume also contains the meteorological tables for 1896, and essays by M. Eginitis on ancient observations of meteor showers, the increase of the discs of the sun and moon at the horizon, and the solar eclipse of August 8, 1896.

TWO observers in the May number of the *Zoologist* note the effect of the unusually cold and late spring on the bird-life of the country. Mr. W. W. Fowler states that after a careful search, on April 10, in the neighbourhood of Chipping Norton, he was unable to discover a single specimen of the summer migrants which ought by that time to be numerous. Mr. W. Wilson, on the other hand, comments on the late pairing of lapwings and partridges in Scotland.

IN the April number of the *Victorian Naturalist*, Mr. D. Le Souef gives an interesting account of the plants and animals met with during a visit to Western Australia. In several passages he comments on the diminution in the number of wild mammals. The rabbit-bandicoot, for example, has disappeared from districts where it was formerly numerous, owing to "ringing" the timber and cultivation; while the common phalanger, or "opossum," has been practically exterminated from the settled districts.

TO the *Revue générale des Sciences* of May 15, Monsieur P. Glangeaud contributes a notice of the biological laboratory recently established among the extinct volcanoes of the Auvergne. The principal object seems to be the investigation of the fauna and flora of the numerous lakes, several of which are of great depth and cover a large area. Already important observations have been made with regard to the "plankton" of the lakes. On the salt plains the existence of a marine fauna has long been known, and the discovery is now announced of the survival there of a marine fauna.

WE have received the fourth number of the *News Bulletin* of the Zoological Society of New York, which contains a popular illustrated account of some of the new buildings in the menagerie, as well as of several of the most notable animals. Some of the photographs, especially those of polar bears, of a group of wapiti (elk), and of a bull bison, are exquisite productions. We are, however, sorry to note that there is a deficiency of funds for the support of the zoological park; and an earnest appeal is made by the Board of Managers to induce more of the residents of New York to become members of the Society.

MR. J. K. BARTON has sent us a copy of a paper on the anatomy of the digestive tract of the salmon, published in the April number of the *Journal of Anatomy and Physiology*. The object of the investigation was to determine the truth of the statement that when salmon enter our estuaries they are suffering from a degenerative catarrh of the mucous membrane of the intestines, which subsequently spreads upwards to the stomach. The examination of a considerable number of specimens is

stated to refute this assertion, and that previous observers have been misled by the effects of the methods employed in their investigations.

PART III. of "A Manual of Surgical Treatment," by Dr. W. Watson Cheyne, F.R.S., and Dr. F. F. Burghard, has been published by Messrs Longmans, Green and Co. The subject is the treatment of the surgical affections of the bones, and amputations. We propose to review the work when the six parts of which it will be composed have been published.

THE fifth revised and enlarged edition of Dr. Richard Hertwig's "Lehrbuch der Zoologie" has just been published by the firm of Gustav Fischer, Jena. As with other zoological text-books, many alterations and additions have had to be made in order to bring it in touch with the present state of knowledge.

THE material collected by Dr. Arthur Willey from New Britain, New Guinea, Loyalty Islands and elsewhere, when in search of the eggs of the Pearly Nautilus, during the years 1895-97, has proved exceptionally rich in subjects of study. Part iv. of the "Zoological Results" (Cambridge: University Press) contains ten papers upon various forms of life, and Part v. is in the press. The original intention was to complete the work in five or six parts.

A NEW sugar has been discovered by M. Gabriel Bertrand, by the action of the sorbose bacterium upon erythrite, and is described by him under the name of erythrulose in the *Comptes rendus* for May 14. By its reactions it appears to be a ketone of the composition  $\text{CH}_2(\text{OH})\cdot\text{CO}\cdot\text{CH}(\text{OH})\cdot\text{CH}_2\text{OH}$ , thus being a lower homologue of levulose. Erythrulose is not fermentable by yeast, but forms a well crystallised osazone; it resists oxidation by bromine water, and hence is probably a ketone.

A NEW general method of preparing secondary and tertiary alcohols, which, on account of the excellent yields obtainable, promises to be of considerable service, is described by M. V. Grignard in the current number of the *Comptes rendus*. Magnesium turnings react but slowly with methyl iodide at ordinary temperatures, but in presence of ether a violent reaction takes place, resulting in a clear solution probably containing  $\text{CH}_3\cdot\text{MgI}$ . If to this solution an aldehyde or ketone is added, and the product treated with dilute acid, about 70 per cent. of the theoretical amount of the corresponding secondary or tertiary alcohol can be isolated. Thus methyl iodide and acetaldehyde give isopropyl alcohol; benzaldehyde and isobutyl bromide give phenylisobutyl-carbinol; methyl iodide and acetophenone, dimethyl-phenyl-carbinol.

THE additions to the Zoological Society's Gardens during the past week include a Squirrel Monkey (*Chrysotrrix sciurea*) from Guiana, presented by Mr. Percy L. Isaac; an Ocelot (*Felis pardalis*) from South America, presented by Mr. M. A. French; an Allen's Porphyrio (*Hydroornia alleni*) captured at sea, presented by Captain J. C. Robinson; a Snowy Owl (*Nyctea scandiaca*, ♀) from Bylott Island, Lancaster Sound, presented by Mr. A. Barclay Walker; two Long-eared Owls (*Asio otus*), European, presented by Mr. D. F. Campbell; six Long-nosed Crocodiles (*Crocodilus cataphractus*) from West Africa, presented by Mr. J. S. Budgett; four Blood-rumped Parrakeets (*Psephotus haemalonotus*), two Rose Hill Parrakeets (*Platycercus eximius*), two Crested Pigeons (*Ocyphaps lophotes*), two Plumed Ground Doves (*Geophaps plumifera*), two Black and White Geese (*Anseranas semipalmata*) from Australia, two African Tantaluses (*Pseuilotantalus ibis*), two Senegal Touracous (*Turacus persa*) from West Africa, purchased; two King Snakes (*Coronella getula*), a Coralline Snake (*Coronella gentilis*),

two American Black Snakes (*Zamenis constrictor*), ten Pennsylvanian Mud Terrapins (*Cinosternum pennsylvanicum*), four Adorned Terrapins (*Chrysemys ornata*), thirteen Elegant Terrapins (*Chrysemys scripta elegans*), six Lesueur's Terrapins (*Malacoclemmys lesueurii*), six Red Newts (*Sperlepes ruber*) from North America, a Garnett's Galago (*Galago garnetti*) from East Africa, a Serval (*Felis serval*) from Africa, a Common Teguxin (*Tupinambis teguexin*), three Annulated Terrapins (*Nicoria annulata*) from South America, four Blue Wall Lizards (*Lacerta muralis*, var. *coerulea*) from Faraglione, five Schlagintweit's Frogs (*Rana cyanophlyctis*) from Southern Asia, deposited; a Barbary Wild Sheep (*Ovis tragelaphus*, ♂), born in the Gardens.

OUR ASTRONOMICAL COLUMN.

THE DARK FRINGES OBSERVED DURING TOTAL SOLAR ECLIPSES.—We have received a communication from Señor V. Ventosa, astronomer at the Madrid Observatory, concerning the appearance and probable cause of the dark fringes—or “shadow bands” as they are generally called—which are always observed some few seconds before and after totality during the progress of a total eclipse of the sun. The chief points of his communication are here summarised.

These alternating dark and bright fringes are parallel to each other, all moving in the same direction, but the velocity varies greatly from time to time. Several reasons have been advanced to account for their appearance, chief of which are those regarding them as (1) diffraction fringes bordering the actual shadow of the moon on the earth's surface; (2) shadow phenomena produced in the body of our own atmosphere, and affected by the direction of the wind. The examination of the observed facts appears to support to some extent those holding the latter view, as while the bands may be well seen in one place, they may be invisible in a neighbouring locality; their form, generally rectilinear or slightly undulating, is also variable, while their breadth has been variously estimated from 1 cm. to 50 cm., although this will, of course, partly depend on the inclination of the surface on which they are observed. Sometimes they move with about the speed of a man walking, at others with the speed of an express train, the velocity always being less, however, than that of the shadow itself. (During the coming eclipse the shadow will move through 800 kilom. in 12 minutes.)

Señor Ventosa has been occupied for some time in studying the currents in the higher regions of our atmosphere by observing the undulations round the sun and stars with a telescope, and thinks that these upper atmospheric currents may possibly have some bearing on the question of the eclipse shadow bands; the movement of these higher portions showing through the quieter lower strata and being rendered visible on account of different refractive powers. He thinks it would be useful to determine the velocity of these currents by anemometers at various altitudes, and also to observe the undulations round the limb of the sun at the time of eclipse, comparing them with the shadow bands in direction and velocity of movement. To ascertain if any experimental illustration of this hypothesis could be presented, he states that bands may be produced by passing diffuse light reflected from a sheet of corrugated glass through a circular aperture representing the sun, over which an opaque disc, representing the moon, is made to slide. When the segment left uncovered is about 5 mm. in width, alternate bright and dark bands can be observed on a white screen held near, if the length of the segmental opening is approximately parallel to the undulations of the glass, but if at right angles they entirely disappear. He trusts, however, that his putting forward this hypothesis for establishing a connection between eclipse shadow bands and atmospheric undulations will show the advisability of recording the direction and velocity of the wind during eclipses, so that more definite data may be available for discussion.

PHOTOMETRY OF CORONA, APRIL 16, 1893.—In a communication recently made to the Royal Society, Prof. H. H. Turner, F.R.S., gives the details of procedure and results obtained in photometric observations of the corona during the total eclipse of the sun in April 1893. The visual brightness of

the corona was determined by Prof. T. E. Thorpe at the eclipses of 1886 August 29, and 1893 April 16, by a method arranged by Sir W. Abney (*Phil. Trans. A*, 1889, p. 363, and 1896, p. 433), but soon after the first of these, Sir W. Abney devised a method of comparing the coronal light with that of a fixed standard by photographic means. This method was first put into practice at the eclipse of 1889, and has been repeated systematically since. Part of the photographic plate, before being taken for eclipse use, is exposed to a graduated series of exposures from a standard source of light in the laboratory, and then without development is afterwards used to receive the impression of the corona, the part carrying the previous standard exposures being protected from further light action. On subsequent development there results a picture of the corona, and a series of squares of graduated densities on the same plate, so that the brightness of any part of the coronal structure may be directly compared with the brightness of the standard light of the laboratory.

The 1889 photographs have not yet been measured, but Prof. Turner has reduced several of the plates taken in 1893 by Sergeant Kearney at Fundium, Africa. These were obtained with the “double tube” apparatus, giving pictures of two sizes, the moon's disc being 0.6 inch and 1.5 inches in diameter. Examples of each scale image were examined, one of the large scale photographs, taken with an exposure of 50 seconds, being specially carefully measured along four radii extending due N., S., E., W., from the limb respectively, and the resulting table of comparison measures is included in the present paper. This table shows:—

- (1) That the accuracy of the method is such that the intensity of the light is determinable within a very small error.
  - (2) The intensity of the coronal light falls off in nearly the same manner in all four directions (1893 was near a sun-spot maximum, with corona of symmetrical form). There is a marked difference, however, between the intensities along the north and south radii.
  - (3) The falling off in intensity is at first exceedingly rapid, becoming very gradual at distances more than 45 minutes from the limb.
  - (4) The absolute brightness of the corona in terms of the “moon” by using a conversion factor.
- Prof. Turner then compares the brightness thus determined photographically with that obtained visually by Abney and Thorpe, and presents two curves showing the combined observations, which show a marked agreement between the results arrived at in such different ways. No measures of brightness, however, were made *visually* within 0.6 of a radius from the limb, and it would be useful if this were done at the coming eclipse.

MAXIMUM DURATION OF TOTALITY FOR SOLAR ECLIPSE.—Mr. C. T. Whitmell sends us the following corrections to the data given in the abstract of his paper last week (p. 64):—

Earth's radius	to be taken as	3963'296 miles.
Moon's „	„ „ „	„ 1080'000 „

The eclipse for which the totality will be a maximum will take place at noon about the beginning, not the middle, of July.

SOME MODERN EXPLOSIVES.<sup>1</sup>

NEARLY thirty years ago, in the Royal Institution, I had the honour of describing the great advances which had then recently been made both in our knowledge of the phenomena which attend the decomposition of gunpowder, and in its practical application to the purposes of artillery.

I described the uncertainty which up to that date had existed as to the tension developed by its explosion, the estimates varying enormously from the 101,000 atmospheres (about 662 tons on the square inch) of Count Rumford to the 1000 atmospheres (6.6 tons per square inch) of Robins, or, taking more modern estimates, from the 24,000 atmospheres (158 tons per square inch) of Piolet and Cavalli to the 4300 atmospheres (about 29 tons per square inch) of Bunsen and Schischkoff.

These uncertainties were, I think I may say, set to rest by certain experiments carried out both in guns and close vessels at Elswick, by the labours of the Explosive Committee appointed

<sup>1</sup> A Discourse delivered at the Royal Institution on Friday, March 23, by Sir Andrew Noble, K.C.B., F.R.S.